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Title: Are walking treatment beliefs and illness perceptions associated with walking intention and 6-Minute Walk Distance in people with intermittent claudication? A cross-sectional study

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Abstract

Intermittent claudication (IC) is debilitating leg pain affecting older people with peripheral arterial disease, which is improved by regular walking. This study evaluated associations between psychosocial variables and 6-Minute Walk Distance (6MWD) to identify factors that motivate walking. 142 Individuals with IC (116 males, mean 66.9y [SD=10.2]) completed cross-sectional assessments of sociodemographics, walking treatment beliefs and intention (Theory of Planned Behaviour [TPB]), illness perceptions (Revised Illness Perceptions Questionnaire), and 6MWD. Multiple linear regression evaluated relationships between treatment beliefs (block 1) and illness perceptions (block 2) with intention and 6MWD. TPB constructs were associated with intention ($R=.72$, $p<.001$) and 6MWD ($R=.08$, $p<.001$). Illness perceptions were associated with 6MWD only ($R=.27$, $p<.001$). Intention ($\beta=.26$), treatment control ($\beta=-.27$), personal control ($\beta=.32$), coherence ($\beta=.18$), and risk factor attributions ($\beta=.22$; all $p<0.05$) were independently associated with 6MWD. Treatment beliefs and illness perceptions associated with intention and 6MWD in people with IC are potential intervention targets.

[150 words]

Keywords

Walking capacity; behaviour change; illness representations

Introduction

Peripheral arterial disease (PAD) is an age-related condition characterised by atherosclerosis, and narrowing or occlusion in the arteries of the lower limb, and affects up to 20% of older adults (Selvin & Erlinger, 2004). A common symptom of PAD is intermittent claudication (IC), a debilitating ischaemic leg pain, which occurs during walking. IC contributes to reduced mobility, quality of life, low mood, and increased cardiovascular risk (Brostow, Petrik, Starosta, & Waldo, 2017; Garg et al., 2006; Regensteiner et al., 2008), and it is therefore an important but complex condition to manage.

Whilst walking is a trigger that brings on IC, engaging in regular walking exercise can, over time, improve symptoms and increase walking capacity by up to 200% (Lane, Ellis, Watson, & Leng, 2014). Increased walking is associated with greater functional mobility, including stair climbing (Gardner et al., 2001), and may improve the performance of activities of daily living. International management guidelines for IC recommend ≥30 minutes of walking on ≥3 days/week at an intensity that induces moderate pain within 3-5 minutes (Norgren et al., 2007). Supervised centre-based programmes are optimal, but due to lack of resources, healthcare professionals frequently advise patients to walk independently; however, initial engagement and adherence to walking advice is low, with most individuals not achieving walking guidelines (Bartelink, Stoffers, Biesheuvel, & Hoes, 2004). This contributes to high disability, cardiovascular morbidity and mortality in people with IC (Garg et al., 2006; 2009).

There is a need for effective interventions to enable people with IC to achieve treatment recommendations and improve walking capacity (Galea, Weinman, White, & Bearne, , 2013). Psychosocial factors, such as beliefs about the impact of engaging in walking on health, lack of understanding of walking guidance, and beliefs about disease severity, are reported barriers to IC self-management (Galea Holmes, Weinman, & Bearne, 2015).

Walking treatment is a complex health behaviour, which may rely on deliberate plans, and adequate personal and environmental resources to overcome barriers to participation. The Theory of Planned Behaviour (TPB) (Ajzen, 1991) defines social-cognitive determinants of behaviour as attitudes (i.e., positive or negative evaluations of engaging in the recommended walking treatment), subjective norms (i.e., perceived evaluations of important referents regarding the recommended walking treatment), and perceived behavioural control (PBC; i.e., perceived ease or difficulty of performing the recommended walking treatment). The TPB consistently demonstrates large and small effects, respectively, on intention and health behaviours, including physical activity (Hagger, Chatzisarantis, & Biddle, 2002; McEachan, Conner, Taylor, & Lawton, 2011), and explained exercise adherence among individuals with chronic illness (Rich, Brandes, Mullan, & Hagger, 2015). TPB constructs explained 67% of variance in walking intention among individuals with IC in two observational studies (Galea & Bray, 2006; 2007), but the model did not consistently explain self-reported walking behaviour and is therefore incomplete.

The TPB has been criticised for its parsimony and limited ability to account for behaviour (Sniehotta, Presseau, & Araújo-Soares, 2013), in particular objective measures of walking (Scott, Eves, French, & Hoppé, 2007), highlighting a need to evaluate extended models or to combine theoretical frameworks to progress our understanding of health behaviour and underpin interventions (Hardeman et al., 2002; Noar & Zimmerman, 2005). It is recommended that the utility of general theories of behaviour change (e.g., TPB) are explored initially, and health-specific theories be applied subsequently to improve understanding (Sutton, 2005). In individuals with PAD, beliefs about their illness may contribute, in addition to those defined by the TPB, to understanding walking behaviour change, and are defined by the Common Sense Model of Illness Representations (CSM) (Leventhal, Nerenz, & Steele, 1984). The CSM proposes that individuals try to make sense of their illness and symptoms, and engage in coping behaviours (e.g. pain avoidance, exercise) that are consistent with their representations about the illness timeline (i.e., perceptions of the illness as acute, chronic, or cyclical), consequences (i.e., perceptions about illness severity), controllability (i.e., self- or treatment-efficacy to control or cure the illness), and coherence (i.e., perceived understanding and plausibility of the illness representation). Illness perceptions, defined by the CSM, were consistently associated with coping strategies, physical and psychological health outcomes in individuals with long-term illnesses (Hagger & Orbell, 2003) and predicted attendance at cardiac rehabilitation, although effects were small (French, Cooper, & Weinman, 2006). CSM constructs have not been evaluated as determinants of walking in individuals with IC and describe different, but potentially complementary, cognitive processes that drive health behaviour to TPB constructs. Both treatment beliefs and illness perceptions should be assessed to facilitate adherence (Leventhal, Phillips, & Burns, 2016), and so the TPB and CSM together could provide a more complete understanding of walking and a theoretical underpinning for interventions targeting walking as treatment for IC.

While walking behaviour change is an important target of exercise therapy for IC, a primary clinical treatment aim includes improvements in walking capacity (Norgren et al., 2007). The 6-minute walk distance (6MWD) is a valid, reliable and objective measure of walking capacity (McDermott et al., 2008; Montgomery & Gardner, 1998), which is a valuable clinical outcome. In addition, the 6MWD is associated with walking behaviour measured by accelerometer in individuals with IC (McDermott et al., 2008), and therefore provides a meaningful outcome when evaluating constructs from health behaviour theories. However, no studies involving individuals with IC have explored constructs defined by the TPB or CSM, alone or in combination, as determinants of the 6MWD. A cross-sectional observational evaluation contributes to the literature by providing initial insight to the relationships between constructs, enables data collection at one assessment thereby reducing burden for people with IC who have limited mobility, and is a pragmatic design for the clinical setting of this study. Therefore, the aim of this study is to evaluate the TPB and CSM together to identify associates with walking intention and 6MWD in people with IC.

Study Hypotheses

Building on previous research demonstrating a large effect of TPB constructs (i.e., beliefs about engaging in recommended walking treatment for IC) on walking intention and a small effect on walking behaviour (Galea & Bray, 2006; 2007), our hypotheses evaluated the additional effect of CSM constructs (i.e., illness perceptions) on walking intention and 6MWD, after controlling for TPB constructs.

Specifically, it was hypothesised that:

1) illness perceptions will account for significant variance in walking intention while controlling for TPB constructs (attitude, subjective norm, and PBC);

2) TPB constructs (PBC and walking intention) will account for significant variance in 6MWD; and

3) illness perceptions will account for significant variance in 6MWD while controlling for TPB constructs (PBC and walking intention).

Methods

Study Design and Research Governance

This cross-sectional, observational study gained ethical and research governance approval from NRES Committee London – London Bridge (reference 11/LO/0871) and the Departments of Research and Development, Guy’s & St Thomas’ NHS Foundation Trust and King’s College Hospital NHS Foundation Trust.

Sampling and Recruitment

Participants were identified by the direct care team in vascular outpatient clinics at three tertiary centres in London, UK, and contacted by a researcher for screening and to arrange an assessment. A medium effect (f^2=0.15, equivalent to R^2=0.13) in variance of 6MWD with α=0.05, power of 0.80, and including 15 predictor variables required 139 participants (Faul, Erdfelder, Buchner, & Lang, 2009). To account for up to 10% missing data (Roth, 1994), the target sample size was 153 participants.

Inclusion and Exclusion Criteria

Adults (aged ≥18 years) with established IC (diagnosed via ankle-brachial pressure index, duplex ultrasound, computed tomography or magnetic resonance imaging) (Norgren et al., 2007) were included.

Exclusion criteria were: a) revascularisation (e.g., endovascular treatment or bypass surgery) scheduled within 3 months; b) presence of a comorbidity other than IC self-reported as the primary limitation of walking (e.g., knee osteoarthritis); c) presence of a condition for which it is unadvisable to increase walking (e.g., unstable angina); and/or d) inability or refusal to provide informed consent.

Measures

Sociodemographic and clinical characteristics. Age, gender, relationship status, ethnicity, tobacco smoking, cardiovascular risk factors, current medication for IC, other mobility-limiting symptoms or conditions, and participation in a supervised exercise programme in the past 3 years were assessed by self-report. History of revascularisation was determined from medical records. Height (centimetres) and weight (kilograms) were measured using standard scales to determine body mass index.

Lower-limb symptom classification. The San Diego Claudication Questionnaire (SDCQ) is a sensitive and specific (Schorr & Treat-Jacobson, 2013) 8-item measure which categorises PAD symptoms as 1) asymptomatic (having no symptoms upon exertion or rest); or as having

2) atypical exertional leg symptoms (symptoms that occur upon exertion and do not meet the criteria for IC); 3) IC (exertional calf pain that requires the individual to stop walking, resolves within 10 minutes rest, and does not begin at rest or resolve during walking); or 4) leg pain on exertion and rest (Criqui et al., 1996; McDermott, Mehta, & Greenland, 1999).

6-Minute Walk Distance (objective walking capacity). The 6MWD was assessed during a 6 Minute Walk Test, a standardised submaximal exercise test (American Thoracic Society, 2002; Montgomery & Gardner, 1998). Participants were asked to walk as far as possible around two cones, placed 30.48 metres apart, in 6 minutes. The test was completed twice, and the distance walked (metres) during the second test was used for analyses. The 6MWD demonstrates 2-week test-retest reliability, and concurrent validity with PAD severity and accelerometer-derived physical activity in individuals with IC (McDermott et al., 2008; Montgomery & Gardner, 1998). In healthy adults (aged 40-80 years) the 6MWD was mean 571 (SD=90; range 380-782) (Casanova et al., 2011). Comparable 6MWD scores for people with a normal ABPI (0.9-1.50) and those with mild/moderate PAD (ABPI=.50 to <.90) and moderate/severe PAD (ABPI<.50) were mean 414 m (SD=160), 337 (SD=142), and 241 (SD=141), respectively (McDermott et al., 2004).

Pain-free and maximal walking ability. The valid and reliable, disease-specific, pain-free walking ability and maximal walking ability reflect walking duration (seconds) before the self-reported perceived onset of IC or before IC causes the individual to stop and rest, respectively, during the 6 Minute Walk Test (Montgomery & Gardner, 1998; Zwierska et al., 2004).

Perceived activity intensity. The rating of perceived exertion assessed perceived activity intensity before and after the 6 Minute Walk Test on a categorical scale (6="no exertion at all" to 20="maximal exertion") (Borg, 1998). The rating of perceived exertion corresponds with maximal ventilatory oxygen uptake in individuals with IC (Zwierska et al., 2005).

Perceived pain intensity. Participants rated their IC before and after the 6 Minute Walk Test on the Category–Ratio 10 Scale for Pain (CR10; 0="nothing at all" to 10="maximal pain") (Borg, 1998). The CR10 demonstrates test-retest reliability and is validated against the maximal walking distance in people with IC (Galea & Bray, 2006; Zwierska et al., 2005).

Beliefs about engaging in walking as treatment for IC. A 23-item TPB questionnaire was adapted from a previous measure administered to individuals with IC (Galea & Bray, 2006; 2007) to assess beliefs about walking treatment. Instructions defined walking guidelines for people with IC (≥30 minutes of walking on ≥3 days/week) (Norgren et al., 2007), and items assessed participants' attitude (8 items) on 7-point bipolar adjective scales (1=unpleasant, 7=pleasant), and subjective norm (4 items), PBC (7 items), and intention (4 items) regarding "the recommended walking exercise" on 7-point Likert scales (1=strongly disagree, 7=strongly agree). Higher total scores represented more positive walking treatment beliefs. The TPB scales demonstrated internal consistency (Cronbach's α>0.70) and were associated with self-reported walking behavior in people with IC (r=0.37–0.56, p<0.05) (Galea & Bray, 2006; 2007).

Illness perceptions. The Revised Illness Perception Questionnaire (IPQ-R) is a valid and reliable measure of individuals' representation of their illness as defined by the CSM (Moss-Morris et al., 2002). Symptom identity is explored using 14 items assessing the occurrence of common symptoms (yes/no). Illness perceptions are assessed by 38 items reflecting acute timeline (6 items), cyclical timeline (4 items), consequences (6 items), personal control (6 items), treatment control (5 items), coherence (5 items), and emotion (6 items) regarding PAD, which are evaluated on a 5-point scale (1=strongly disagree, 5=strongly agree). Using the same 5-point scale and anchors, 18 items assess causal attributions reflecting psychological attributions (6 items"), risk factors (7 items), immunity (3 items) and accident or chance (2 items).

Procedure

Participants attended one 90 minute appointment. Following informed consent, questionnaires assessing sociodemographic characteristics, and lower-limb symptom classification were completed and participants' body mass index recorded. Following the initial 6 Minute Walk Test participants rested for ≥20 minutes and completed the IPQ-R and TPB questionnaires. During the second 6 Minute Walk Test, the 6MWD, pain-free walking ability, maximal walking ability and pre- and post- measures of perceived activity and pain intensity were assessed.

Analyses

Analyses were completed using SPSS Statistics Software version 21.0 (IBM Statistics Inc., Armonk, NY, USA). Statistical significance was set at $p<0.05$. Participants missing >10% of questionnaire data at the item level were excluded.

Frequencies and mean (standard deviation [SD]) values were reported for categorical and continuous descriptive variables, respectively. Mean difference scores and 95% confidence intervals (CIs) were computed for pre- and post-test pain (CR10) and activity intensity (i.e., rating of perceived exertion), and the 6MWD. Non-normal data (subjective norm, walking intention, accident/chance attributions, and identity) were transformed for analysis using the Log_{10} or square root method to produce the best approximation of normality, and reported in their original scales for clarity (Tabachnick & Fidell, 2013).

Bivariate relationships between CSM and TPB constructs, and the criterion variables (i.e., walking intention or 6MWD) were explored using two-sided Pearson correlation coefficients. Hypotheses were evaluated using two hierarchical multiple linear regression analyses. Univariate (Studentised residual values ±3SD) and multivariate outliers (Mahalaonobis distance $p<0.01$) were excluded, and models were evaluated for multicollinearity, normal and independent errors, and homoscedasticity. Each model included two blocks: TPB variables were entered in block one, and illness perceptions were entered in block two.

Results

Participants

In total, 469 patients were identified for the study: 208 were excluded, 52 could not be contacted and 57 declined to participate. Overall, 152 individuals with IC were enrolled. One participant withdrew during questionnaire completion, 6 participants had >10% missing data, and 3 outliers were identified and excluded. Data for 142 individuals were included in the analyses. Sociodemographic and clinical characteristics did not differ substantially between excluded and included participants.

Most participants were male (80%), and white British (80%). Nearly one-quarter (24%) of participants had attended a supervised exercise programme within the previous 3 years. Classic IC was the most common symptom classification (48%); two participants categorised as asymptomatic on the SDCQ subsequently reported IC during the 6 Minute Walk Test (Table 1).

Descriptive Results

Mean 6MWD was 365.0 metres (95% CI 347.3, 382.7; range 62.2–581.2). Pain increased by 3.7 points (95% CI 3.3, 4.0), and perceived exertion by 5.0 points (95% CI 4.5, 5.5) following the 6 Minute Walk Test. Overall, 75 (52%) participants reported their pain-free walking ability (128.4 seconds, 95% CI 114.0, 143.0) and 36 (25%) participants stopped to rest during the 6 Minute Walk Test, recorded as their maximal walking ability (185.9 seconds, 95% CI 154.8, 216.9).

Summary scores and bivariate correlations for psychosocial predictors and criterion variables are presented in Table 2. Mean (SD) scores indicate positive beliefs about walking treatment (attitude, subjective norm, PBC, and intention). Scores for illness perceptions indicated an acute timeline, and high personal control, treatment control, coherence, risk factor attribution, consequences and emotional impact of PAD.

Hypothesis 1: Model Accounting For Walking Intention

TPB variables (block one) accounted for 72% of variance in walking intention, $\Delta F(3, 138)=120.90$ ($p<0.001$). Illness perceptions (block two) accounted for an additional, non-significant, 4% of variance, $\Delta F(12, 126)=1.693$ ($p=0.076$). The final model accounted for 73% of variance in walking intention, $F(15, 126)=26.99$ ($p<0.001$). Attitude, subjective norm, and PBC were significant correlates (Table 3).

Hypotheses 2 and 3: Model Accounting For 6MWD

TPB variables (block one) accounted for 8% of variance in 6MWD, $\Delta F(2, 139)=6.69$ ($p=0.002$). Neither intention nor PBC were independently associated with 6MWD. Illness perceptions (block two) accounted for an additional 27% of variance, $\Delta F(12, 127)=4.37$ ($p<0.001$). The final model accounted for 28% of variance in 6MWD, $F(14, 127)=4.979$ ($p<0.001$). Intention, treatment control, personal control, coherence, and risk factor attributions were independently associated with 6MWD (Table 3). Unstandardised beta coefficients indicated that for every 1 unit increase in scores reflecting intention, personal control, coherence, and risk factor attributions, 6MWD increased by 23.6 (95% CI 2.8, 44.3), 9.3 (95% CI 3.8, 14.7), 4.9 (95% CI 0.2, 9.6), and 5.2 (95% CI 1.1, 9.3) metres, respectively; and for every 1 unit increase in treatment control, 6MWD decreased by 9.2 metres (95% CI -15.2, -3.2).

Discussion

This study demonstrated that beliefs about walking treatment defined by the TPB are associated with walking intention in people with IC, whereas both beliefs about walking treatment (TPB) and illness perceptions defined by the CSM are associated with 6MWD. Independent correlates with 6MWD were identified from both models and included intention, treatment and personal control, coherence and risk factor attributions.

This is the first study to evaluate the associations of constructs from both the TPB and CSM with walking intention in people with IC, and to explore their relative and combined contributions to an objective measure of walking capacity. Findings confirmed that TPB constructs account for most (72%) of the variance in walking intention, with subjective norm having the largest independent association, followed by PBC and then attitude. This is consistent with other work exploring the TPB in IC (Galea & Bray, 2007), but contrary to research on exercise and physical activity in healthy individuals, where subjective norm is consistently the weakest predictor of intention (Hagger et al., 2002). The relative importance of TPB variables can vary depending on the context, population, or behavioural outcome (Ajzen, 1991), and so, in people with IC, support from one's medical practitioner, partner, or closest family member or friend may be central to facilitate walking.

CSM constructs collectively were not associated with walking intention, although zero-order relationships between illness perceptions and intention linked higher treatment control, personal control, and coherence to positive walking intention, and perceptions of PAD as acute or caused by accident to lower intentions. Our findings compare with one other study which evaluates the CSM and TPB together to explain health behaviour intentions, including physical activity, in patients with familial hypercholesterolemia (Hagger et al., 2016), which reported no effect of CSM constructs on intention, and no binary relationships. One explanation for the limited role of illness perceptions in accounting for intention is that they comprise an implicit schematic cognitive framework (Leventhal et al., 1984), which may supersede explicit intention formation. Illness perceptions could, instead, affect walking directly or via alternate pathways, such as mediation or moderation by volitional factors (e.g., PBC or action planning) or implicit motivation (Hagger & Chatzisarantis, 2014).

Together intention and PBC accounted for 8% of variance in 6MWD, although only intention was associated with 6MWD in the final model. This is lower compared with data from two large systematic reviews (Hagger et al., 2002; McEachan et al., 2011), both which reported that the TPB accounted for 24% of the variance in physical activity, including walking**.** However, there were limited data reflecting older adults with long-term conditions, like IC, for whom additional factors beyond those defined by the TPC could be salient. Accordingly illness perceptions explained an additional 27% of variance in 6MWD, suggesting additional salient correlates in this population. An additional factor which may explain the small variance in 6MWD explained by intention and PBC is measurement incompatibility between self-reported TPB constructs and objectively measured 6MWD. While it is recommended that measurement compatibility is maximised in research evaluating the TPB, for example by using self-reported outcomes with similar wording to the construct measures, this comes with a risk of inflating associations (i.e., common method variance; Kaiser, Schultz, & Scheuthle, 2007). The 6MWD is a validated, clinically relevant measure of walking capacity in people with IC (McDermott et al., 2008), and provides an accurate reflection of actual walking behaviour compared with less robust, self-reported measures.

However, PBC, an important predictor of self-reported walking behaviour in individuals with IC (Galea & Bray, 2006; 2007), was not associated with 6MWD. Participants may hold inaccurate control and confidence beliefs, or anticipate general barriers to walking (e.g., lack of time), regardless of their walking capacity. Prompting individuals to consider potential barriers to walking could improve the accuracy and predictive utility of PBC. Rejeski et al. (2008) reported lower barrier self-efficacy in individuals with IC who had the poorest 6MWD (<976 feet versus >1,285 feet; $p=0.0005$). However, the barrier self-efficacy scale used reflected common challenges to being physically active rather than disease-specific walking barriers (e.g., lack of a place to stop walking and rest) (Galea, Bray, & Martin Ginis, 2008), which may provide a more robust measure.

Illness perceptions accounted for 27% of variance in 6MWD. Personal control, treatment control, coherence, and risk factor attributions were independent determinants. Treatment control was inversely associated with 6MWD; however, people with IC largely focus on medical or surgical management for their IC (Galea Holmes et al., 2015), so participants may not consider walking as treatment when responding to general treatment control items on the IPQ-R (for example, “My treatment will be effective in curing my PAD”). This suggests that individuals who believe revascularisation (i.e., angioplasty or bypass surgery) or other medical treatment could improve or alleviate their IC are likely to walk less.

Other work in patients with chronic obstructive pulmonary disease (COPD) has reported associations between illness perceptions and 6MWD, and found different correlates to our work. In one study Fischer et al (2010) reported a moderate association between increased 6MWD with decreased perceived consequences and emotional response following 12 weeks of pulmonary rehabilitation. In a second study, baseline illness perceptions accounted for 12% of variance in 6MWD following pulmonary rehabilitation, after controlling for age, gender, mood, COPD severity, and baseline 6MWD (Zoeckler, Kenn, Kuehl, Stenzel, & Rief, 2014); acute timeline, cyclical timeline and emotional response were independent determinants of 6MWD in COPD patients. Collectively, findings suggest illness perceptions are salient determinants of walking capacity in individuals with long-term conditions, and highlight disease-specific differences in modifiable beliefs which may contribute to understanding self-management strategies, such as walking treatment.

One other study evaluated constructs from the TPB and CSM together to explain physical activity. PBC and cyclical timeline were independent predictors of self-reported physical activity 4 weeks following cardiac rehabilitation, and accounted for only 5% of additional variance beyond past behaviour (Sniehotta, Gorski, & Araujo-Soares, 2010). This suggests that different treatment and illness beliefs drive behaviour in this context. However, the sample was small, and a brief measure of CSM variables was used which exhibited poor reliability for personal and treatment control scales, which were salient determinants of walking in our sample.

This study has several strengths. It is the first study to evaluate constructs from the TPB and CSM together using regression analyses to explain objective walking capacity, and the first to do so in people with IC. The 6MWD is a valid and reliable measure of walking, which reduces the risk of common method variance as an artefact of our results, and provides a clinically relevant outcome for people with IC. A large, diverse, and representative sample of 142 individuals with IC was included, which enabled fully powered hypothesis testing.

This study identifies salient cognitions that differentially associate with walking intention and 6MWD among people with IC. However, the cross-sectional design does not inform causality, and it is possible that greater walking capacity leads to more positive illness perceptions and beliefs about walking; a longitudinal observational study or randomised controlled trial could test hypothesised pathways. Participants with asymptomatic PAD also report impaired walking (McDermott et al., 2010), but were not included in this study; therefore, findings cannot be generalised to this subgroup who may report different walking treatment beliefs and illness perceptions. We did not assess duration of symptoms, which is an important clinical characteristic and potential correlate with illness perceptions. Finally, other covariates (e.g. age and gender) were not analysed; however, including these variables in a post-hoc evaluation did not substantially alter our findings.

Conclusions

Beliefs about walking treatment defined by the TPB were associated with walking intention, whereas illness perceptions defined as CSM constructs were not. Both TPB and CSM constructs were associated with 6MWD. In particular, intention, illness coherence, personal control, treatment control, and risk factor attributions regarding PAD should be targeted when developing interventions to facilitate walking in people with IC.

Author Contributions

All authors contributed to the original idea and study design. MGH collected participant data and conducted data analysis. All authors contributed to data interpretation, manuscript preparation and approved the final manuscript.

Declaration of Conflicting Interests

None declared.

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Table 1. Sociodemographic and clinical characteristics of participants

Variable	Value, n (%)
Age, years	66.9 ±10.2[a]
Body mass index, kg/m^2	28.2 ±5.0[a]
Male gender	116 (80.0)
Married or in a civil partnership	61 (42.1)
White ethnicity	116 (80.0)
Current smoker	51 (35.2)
Cardiovascular risk factors	
Diabetes mellitus	50 (34.5)
Cardiovascular disease[b]	63 (43.8)
Hypertension	105 (72.4)
Hyperlipidaemia	101 (69.7)
Renal disease[b]	14 (9.7)
Past heart attack	31 (21.4)
Past stroke[b]	22 (15.2)
Other mobility limiting symptoms or conditions	53 (36.6)
Pharmacological IC management	44 (30.3)
Past supervised exercise therapy	35 (24.1)
Past revascularisation[c]	
None	72 (49.6)
Angioplasty (with or without stent)	21 (14.5)
Bypass surgery	9 (6.2)
Endarterectomy	2 (1.4)

Multiple procedures	2 (1.4)
Lower-limb symptom classification	
No pain	2 (1.4)
Pain at rest	20 (13.8)
Classic IC	69 (47.6)
Atypical IC	54 (37.2)

n=142. [a]Data are mean ±SD. [b]Data are missing for one participant. [c]Data are missing for 39 participants. IC, intermittent claudication.

Table 2. Summary scores and bivariate correlations between walking treatment beliefs, illness perceptions, walking intention, and 6MWD

Variable	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	M	SD
1. Attitude	0.57[a]	0.65[a]	0.13	-0.29[a]	-0.10	0.21[a]	0.29[a]	0.21[b]	-0.30[a]	-0.02	-0.05	-0.10	0.05	0.14	0.37[a]	0.67[a]	0.38[a]	44.9	9.7
2. Subjective norm		0.58[a]	0.04	-0.20[b]	-0.10	0.25[a]	0.21[b]	0.18	0.02	-0.10	0.01	-0.11	-0.16[b]	0.11	0.25[a]	0.75[a]	0.17[b]	23.0[c]	10.0[c]
3. PBC			0.11	-0.14	-0.18	0.16[a]	0.25[a]	0.23[b]	-0.22[a]	-0.16	0.04	-0.19	-0.22[a]	-0.12	0.43[a]	0.72[a]	0.27[a]	31.9	7.2
4. Identity				-0.19[a]	-0.26[a]	0.17	0.12	0.17	-0.40[a]	-0.32[a]	-0.15	-0.18[b]	0.14	-0.45[b]	0.11	0.03	0.16	3.0[c]	4.0[c]
5. Acute timeline[b]					0.4	-0.44[a]	-0.31[a]	-0.11	0.33[a]	0.01	0.29[a]	-0.08	-0.08	0.18[b]	-0.07	-0.23[a]	-0.16[b]	19.9	4.3
6. Cyclical timeline[b]						-0.06	-0.06	-0.50[a]	0.08	0.32[a]	0.04	0.30[a]	-0.27[a]	0.17	-0.04	-0.08	-0.11	11.6	3.5
7. Treatment control							0.49[a]	0.14	-0.16[b]	0.02	0.07	0.08	0.04	-0.12	-0.11	0.20[b]	0.05	17.5	3.7
8. Personal control								0.25[a]	-0.35[a]	0.02	0.17[b]	0.01	0.14	-0.31[a]	0.09	0.19[b]	0.38[a]	20.1	3.7
9. Coherence									-0.20[b]	-0.31[a]	0.04	-0.29[a]	0.22[b]	-0.26[a]	0.10	0.21[b]	0.32[a]	16.9	4.0
10. Consequences[b]										0.24[a]	0.20[b]	0.14	-0.17[b]	0.64[a]	-0.13	-0.01	-0.26[a]	19.4	4.3
11. Psychological attributions[a]											0.28[a]	0.69[a]	-0.42[a]	0.39[a]	-0.11	-0.08	-0.12	13.7	4.6
12. Risk factor attributions												0.25[a]	-0.08	0.20[b]	0.08	-0.02	0.18[b]	20.5	4.5
13. Immunity attributions[b]													-0.53[a]	0.19[b]	-0.06	-0.13	0.01	6.5	2.2
14. Accident/chance attributions[b]														-0.17[b]	0.07	-0.17[b]	-0.06	4.0[c]	2.0[c]
15. Emotion[b]															-0.08	0.09	-0.22[a]	17.4	5.6
17. Walking intention																	0.26[a]	25.0[c]	9.0[c]
18. 6MWD, metres																		367.0	107.0

n=142. [a]p≤0.01. [b]p≤0.05. [c]Data are median (IQR) for variables transformed to their original scales. [b]A lower score indicates a more positive or accurate illness perception. M, mean; PBC, perceived behavioural control; SD, standard deviation; 6MWD, 6 Minute Walk Distance.

Table 3. Associations between walking treatment beliefs and illness perceptions with walking intention and 6MWD: results of multiple linear regression

	Intention					6MWD				
Variables entered	R^2adj	$R^2\Delta$	β	t	p-value	R^2adj	$R^2\Delta$	β	t	p-value
Block 1	0.72	0.72			<0.001	0.08	0.09			0.002
Attitude			0.22	3.58	<0.001			-	-	-
Subjective norm			0.42	7.31	<0.001			-	-	-
PBC			0.35	5.62	<0.001			0.15	1.23	0.221
Intention			-	-	-			0.17	1.43	0.154
Block 2	0.73	0.04			0.076	0.28	0.27			<0.001
Attitude			0.27	4.02	<0.001			-	-	-
Subjective norm			0.35	5.62	<0.001			-	-	-
PBC			0.40	6.24	<0.001			-0.04	-0.30	0.765

Intention	-	-	-	0.26	2.24	0.027
Identity[a]	0.02	0.30	0.768	0.09	1.10	0.275
Acute timeline[a]	-0.08	-1.35	0.181	-0.10	-1.09	0.277
Cyclical timeline[a]	0.10	1.94	0.055	0.02	0.21	0.835
Treatment control	-0.03	-0.61	-0.545	-0.27	-3.04	0.003
Personal control	-0.02	-0.42	0.677	0.32	3.38	0.001
Coherence	0.07	1.27	0.206	0.18	2.05	0.043
Consequences[a]	0.11	1.80	0.074	-0.09	-0.91	0.367
Psychological attributions	0.01	0.11	0.909	-0.20	-1.79	0.075
Risk factor attributions	-0.05	-1.01	0.315	0.22	2.53	0.013
Immunity attributions[a]	0.06	0.85	0.395	0.17	1.55	0.125
Accident/chance attributions[a]	0.10	1.78	0.077	-0.05	-0.62	0.533

Emotion[a]	0.09	1.32	0.190	-0.03	-0.30	0.767

n=142. [a]A lower score indicates a more positive or accurate illness perception. PBC, perceived behavioural control; 6MWD, 6 minute walk distance.